

## PATENT COOPERATION TREATY

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## INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference P34293-P0	<b>FOR FURTHER ACTION</b>		See Form PCT/IPEA/416
International application No. PCT/JP2004/012672	International filing date (day/month/year) 26.08.2004	Priority date (day/month/year) 01.09.2003	
International Patent Classification (IPC) or national classification and IPC G06F17/60, G06F17/50, G05B19/18, H05K13/04			
Applicant MATSUSHITA ELECTRIC INDUSTRIAL CO., LTD. et al.			
<p>1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of 9 sheets, including this cover sheet.</p> <p>3. This report is also accompanied by ANNEXES, comprising:</p> <p>a. <input type="checkbox"/> sent to the applicant and to the International Bureau) a total of sheets, as follows:</p> <p><input type="checkbox"/> sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).</p> <p><input type="checkbox"/> sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.</p> <p>b. <input type="checkbox"/> (sent to the International Bureau only) a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing and/or tables related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).</p>			
<p>4. This report contains indications relating to the following items:</p> <p><input checked="" type="checkbox"/> Box No. I Basis of the opinion</p> <p><input type="checkbox"/> Box No. II Priority</p> <p><input checked="" type="checkbox"/> Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</p> <p><input checked="" type="checkbox"/> Box No. IV Lack of unity of invention</p> <p><input checked="" type="checkbox"/> Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</p> <p><input type="checkbox"/> Box No. VI Certain documents cited</p> <p><input type="checkbox"/> Box No. VII Certain defects in the international application</p> <p><input type="checkbox"/> Box No. VIII Certain observations on the international application</p>			
Date of submission of the demand  31.01.2006		Date of completion of this report  22.02.2006	
Name and mailing address of the international preliminary examining authority:  European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465		Authorized Officer  Sohr, W  Telephone No. +49 89 2399-7185	



**INTERNATIONAL PRELIMINARY REPORT  
ON PATENTABILITY**

International application No.  
PCT/JP2004/012672

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**Box No. I Basis of the report**

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1. With regard to the **language**, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.
- ☐ This report is based on translations from the original language into the following language , which is the language of a translation furnished for the purposes of:
- ☐ international search (under Rules 12.3 and 23.1(b))
  - ☐ publication of the international application (under Rule 12.4)
  - ☐ international preliminary examination (under Rules 55.2 and/or 55.3)

2. With regard to the **elements\*** of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:

**Description, Pages**

1-35 as originally filed

**Claims, Numbers**

1-16 received on 31.01.2006 with letter of 31.01.2006

**Drawings, Sheets**

1/25-25/25 as originally filed

- ☐ a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing
3. ☐ The amendments have resulted in the cancellation of:
- ☐ the description, pages
  - ☐ the claims, Nos.
  - ☐ the drawings, sheets/figs
  - ☐ the sequence listing *(specify)*:
  - ☐ any table(s) related to sequence listing *(specify)*:
4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).
- ☐ the description, pages
  - ☐ the claims, Nos.
  - ☐ the drawings, sheets/figs
  - ☐ the sequence listing *(specify)*:
  - ☐ any table(s) related to sequence listing *(specify)*:

\* If item 4 applies, some or all of these sheets may be marked "superseded."

**INTERNATIONAL PRELIMINARY REPORT  
ON PATENTABILITY**

International application No.  
PCT/JP2004/012672

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**Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability**

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1. The questions whether the claimed invention appears to be novel, to involve an inventive step (to be non-obvious), or to be industrially applicable have not been examined in respect of:
- ☐ the entire international application,
  - ☒ claims Nos. 15
- because:
- ☐ the said international application, or the said claims Nos. relate to the following subject matter which does not require an international preliminary examination (specify):
  - ☐ the description, claims or drawings (*indicate particular elements below*) or said claims Nos. are so unclear that no meaningful opinion could be formed (*specify*):
  - ☐ the claims, or said claims Nos. are so inadequately supported by the description that no meaningful opinion could be formed.
  - ☒ no international search report has been established for the said claims Nos. 15
  - ☐ the nucleotide and/or amino acid sequence listing does not comply with the standard provided for in Annex C of the Administrative Instructions in that:
    - the written form ☐ has not been furnished
    - ☐ does not comply with the standard
    - the computer readable form ☐ has not been furnished
    - ☐ does not comply with the standard
  - ☐ the tables related to the nucleotide and/or amino acid sequence listing, if in computer readable form only, do not comply with the technical requirements provided for in Annex C-*bis* of the Administrative Instructions.
  - ☐ See separate sheet for further details

**INTERNATIONAL PRELIMINARY REPORT  
ON PATENTABILITY**

International application No.  
PCT/JP2004/012672

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**Box No. IV Lack of unity of invention**

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1. ☒ In response to the invitation to restrict or pay additional fees, the applicant has:
- ☐ restricted the claims.
  - ☒ paid additional fees.
  - ☐ paid additional fees under protest.
  - ☐ neither restricted nor paid additional fees.
2. ☐ This Authority found that the requirement of unity of invention is not complied with and chose, according to Rule 68.1, not to invite the applicant to restrict or pay additional fees.
3. This Authority considers that the requirement of unity of invention in accordance with Rules 13.1, 13.2 and 13.3 is
- ☐ complied with.
  - ☒ not complied with for the following reasons:  
**see separate sheet**
4. Consequently, this report has been established in respect of the following parts of the international application:
- ☐ all parts.
  - ☒ the parts relating to claims Nos. 1-14,16 .

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**Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

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1. Statement

Novelty (N)	Yes: Claims	1-14,16
	No: Claims	
Inventive step (IS)	Yes: Claims	
	No: Claims	1-14,16
Industrial applicability (IA)	Yes: Claims	1-14,16
	No: Claims	

2. Citations and explanations (Rule 70.7):

**see separate sheet**

**Re Item III.**

**Non-establishment of opinion with regard to novelty, inventive step and industrial applicability**

Claim 15 does not meet the requirements of Article 6 PCT in that the matter for which protection is sought is not clearly defined.

Claim 15 claims a mounter, but the features of claim 15 are regarding the mounting order the mounter receives, i.e. the mounter of claim 15 cannot be decided from a conventional mounter.

The question of whether the claimed invention appears to be novel, to involve an inventive step, or to be industrially applicable has not been and will not be the subject of the international preliminary examination in respect of the claims which have not been searched (Art. 17(2)(a) or (3) and Rule 66.1(e) PC, see also international search report).

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**Re Item IV.**

**Lack of unity of invention**

The separate inventions/groups of inventions are:

1-2,13,14,16

Optimizing an order of component mounting for a plurality of mounters via identical sub-board patterns; optimizing the order of component mounting for any one pattern

3-10

Adding a number determination step for the number of patterns to be allocated to each mounter

11-12

Optimization by making distances uniform

They are not so linked as to form a single general inventive concept (Rule 13.1 PCT) for the following reasons:

Claim 1 is not inventive over prior art document D1, as explained in 2.1 below. The additional features of each claim of group 1 do not form an inventive general concept with any claim from group 2 or group 3.

Since the applicant has paid further fees for groups 2 and 3, all groups will be treated below.

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**Re Item V.**

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**1 Reference is made to the following documents:**

D1: EP-A-1 227 711 (MATSUSHITA ELECTRIC INDUSTRIAL CO., LTD) 31 July 2002 (2002-07-31)

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**2 INVENTIVE STEP GROUP 1**

2.1 The solution proposed in claim 1 of the present application does not involve an inventive step (Article 33(3) PCT) for the following reasons:

Document D1, which is considered to represent the most relevant state of the art, discloses (the references in parentheses applying to this document):

- An optimization method for optimizing an order of component mounting in a component mounting system having a plurality of placement heads for mounting components on a board

(§[0084] " In this improved step repeat method, the order of mounting of electronic

components is similar to that of the conventional step repeat method as shown in Fig. 7, where the mounting is carried out in the order of chip components -> SOPS -> QFPs as shown by arrows in Fig. 7. More specifically, as placement steps are shown sequentially in Fig. 8, the first steps include sucking up the chip component C1 to the first placement head 38a, the chip component C5 to the second placement head 38b, and the chip component C9 to the third placement head 38c by S-size suction nozzles, respectively, all simultaneously or each individually, moving the transfer head 28, and placing the chip components C1, C5, C9 onto the respective sub-boards in this order"),

- wherein a plurality of patterns having the same component placement structure is included in the board

(§[0056] "Fig. 7 is a view showing an order of placement by an improved step repeat method in an example of a multiple board composed of three sub-boards having an identical pattern"),

and

- the optimization method comprises an allocation step of allocating components, to each of the plurality of mounters, on a per pattern basis

(§[0084] same passage as above; Fig. 8 - all components of the first pattern ("SUB-BOARD" 1) are allocated to mounter ("PLACEMENT HEAD") 1, all of the second pattern to mounter 2, and all of the third pattern to mounter 3)

The difference of claim 1 over the teaching of D1 is that

- where D1 disclosing having multiple "placement heads", claim 1 talks about multiple "mounters" instead.

However, to a skilled person it is known that "multiple mounters" is a general term encompassing independently moving mounters as well as multiple mounters that are fixed relatively to each other and operate with synchronous movement, such as "placement heads" in D1.

Therefore, choosing "multiple mounters" instead of "placement heads" is a choice among obvious design options that a skilled person would take upon circumstances, thus arriving at a solution as set out in claim 1 without using inventive activity. Choosing one option over the other does not achieve any surprising technical effect.

- 2.2 Dependent claim 2 is not considered inventive (Article 33(3) PCT) because optimizing the order of component mounting for any one pattern among the plurality of patterns

is implied by D1 (same passage of §[0084] as cited above).

- 2.3 Independent claims 13, 14, and 16 are not considered inventive (Article 33(3) PCT) for the same reason as claim 1.

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### **3 INVENTIVE STEP GROUP 2**

- 3.1 Dependent claims 3-6 are not considered inventive (Article 33(3) PCT) for the following reason:

A skilled person, implementing the system described in 1.1 above for the common case that there are more patterns than mounters, would have to distribute the patterns to the mounters in an efficient way.

- It is obvious that the patterns should be distributed as evenly as possible to the mounters in order to achieve a balanced load. Therefore, claim 3 is not inventive.

If there are remaining patterns after distributing an equal number of patterns to each mounter as far as possible, there are two choices what to do with them:

- either distributing the remaining patterns to one mounter each, thus arriving at the solution of claim 4,
- or splitting up the remaining patterns into sub-structures that are to be treated by the mounters individually, thus arriving at the solution of claims 5 and 6.

- 3.2 Claim 7 is not considered inventive (Article 33(3) PCT) because it is obvious that said sub-structures of 3.1 should be distributed in a load-balancing way to the mounters, i.e. that the mounting times are approximately equal.
- 3.3 Claim 8 is not considered inventive (Article 33(3) PCT) because a skilled person would avoid placing patterns such that they cannot be reached by any of the plurality of mounters, i.e. patterns would always be placed at "positions in the board on which



components can be mounted by said plurality of mounters"

N.B.:

Possibly the wording "on which components can be mounted by said plurality of mounters" was meant to be "on which components can be mounted by *each of* said plurality of mounters"?

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#### **4. INVENTIVE STEP GROUP 3**

- 4.1 Claims 11 and 12 are not considered inventive (Article 33(3) PCT) because when implementing the "simultaneously" moving mounting heads of D1 (§[0084]), uniform distances from default positions to the patterns and from placement positions to the placement positions are a logical consequence.

**What is claimed is:**

1. (Amended) An optimization method for optimizing an order of component mounting in a component mounting system having a plurality of mounters for mounting components on a board,  
5 wherein a plurality of patterns having the same component placement structure is included in the board, and  
the optimization method comprises an allocation step of allocating components, to each of the plurality of mounters, on a per  
10 pattern basis or per pattern group which is made up of a plurality of patterns.
2. The optimization method according to Claim 1, further comprises a step of optimizing the order of component mounting for  
15 any one pattern among the plurality of patterns.
3. The optimization method according to Claim 1,  
wherein the allocation step includes:  
a pattern number determination step of determining, from a  
20 total number of the patterns included in the board and a number of the mounters, a number of patterns to be allocated to each of the mounters so that the number of patterns is approximately even; and  
a pattern allocation step of allocating the determined number of patterns to any of the plurality of mounters for component  
25 mounting.
4. The optimization method according to Claim 3,  
wherein the pattern number determination step includes:  
a step of calculating a quotient and a remainder by dividing  
30 the total number of the patterns included in the board by the number of mounters;  
a step of determining the quotient as the number of patterns

to be allocated, in the case where the remainder is zero; and  
a step of i) determining a number, which is the quotient plus one, as the number of patterns to be allocated to the same number of mounters as the remainder, starting from the mounter in a process farthest upstream, and ii) determining the quotient as the number of patterns to be allocated to the rest of the mounters, in the case where the remainder is one or greater.

5. The optimization method according to Claim 3,  
wherein the pattern number determination step includes:  
a step of calculating a quotient and a remainder by dividing the total number of the patterns included in the board by the number of mounters; and  
a first allocation sub-step of determining the quotient as the number of patterns to be allocated to each of the mounters.

6. The optimization method according to Claim 5,  
wherein the pattern number determination step further includes a second allocation sub-step of determining the remainder as the number of patterns to be commonly allocated to the plurality of mounters.

7. The optimization method according to Claim 6,  
wherein in the second allocation sub-step, the number of patterns to be commonly allocated to the plurality of mounters is determined so that a time for component mounting for each of the mounters is approximately even.

8. The optimization method according to Claim 6,  
wherein in the pattern allocation step, the patterns to be commonly allocated to the plurality of mounters are located in positions in the board on which components can be mounted by said

plurality of mounters.

9. The optimization method according to Claim 6,  
wherein the plurality of mounters is all of the mounters  
5 Included in the component mounting system.
10. The optimization method according to Claim 3,  
wherein in the pattern allocation step, the determined  
number of patterns are allocated to each of the mounters, as the  
10 patterns on which components are to be mounted, so that borders  
between the determined number of patterns allocated to each of the  
mounters are set orthogonally to a direction in which the board  
moves.
- 15 11. The optimization method according to Claim 1, further  
comprises a step of determining a position of the board during  
component mounting so that a moving distance, from a default  
position to the allocated pattern, of a head of each of the mounters  
is uniform for all of said mounters, the head being used for mounting  
20 components on the board.
- 25 12. The optimization method according to Claim 1, further  
comprises a step of determining placement positions of component  
cassettes used in component mounting so that a distance from the  
placement positions of the component cassettes to the allocated  
pattern, for each of the mounters is uniform for all of said mounters.
- 30 13. (Amended) A program for a component mounting system  
having a plurality of mounters for mounting components on a board,  
wherein a plurality of patterns having the same component  
placement structure is included in the board, and  
the program causing a computer to execute an allocation step

of allocating components, to each of the plurality of mounters, on a per pattern basis or per pattern group which is made up of a plurality of patterns.

- 5 14. (Amended) A computer-readable recording medium on which a program for a component mounting system is recorded, the component mounting system having a plurality of mounters for mounting components on a board,

10 wherein a plurality of patterns having the same component placement structure is included in the board, and

the program causes a computer to execute an allocation step of allocating components, to each of the plurality of mounters, on a per pattern basis or per pattern group which is made up of a plurality of patterns.

15

15. (Amended) A mounter for mounting components on a board according to a mounting order optimized through an optimization method for optimizing an order of component mounting in a component mounting system having a plurality of mounters for mounting components on a board,

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wherein a plurality of patterns having the same component placement structure is included in the board, and

the optimization method includes an allocation step of allocating components, to each of the plurality of mounters, on a per pattern basis or per pattern group which is made up of a plurality of patterns.

25

16. (Amended) An optimization apparatus for optimizing an order of component mounting in a component mounting system having a plurality of mounters for mounting components on a board,

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wherein a plurality of patterns having the same component placement structure is included in the board, and

the apparatus comprises:

an optimizing unit operable to optimize the order of component mounting for any one pattern among the plurality of patterns; and

- 5 an allocating unit operable to allocate components, to each of the plurality of mounters, on a per pattern basis or per pattern group which is made up of a plurality of patterns.